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EXAMINER

TRAN, NHAN T

ART UNIT	PAPER NUMBER
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2615

DATE MAILED: 02/06/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/410,800

Applicant(s)

ACHARYA ET AL.

Examiner

Nhan T. Tran

Art Unit

2615

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 January 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1 and 3-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1 and 3-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.1141.

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 1/13/2006 has been entered.

Response to Arguments

2. Applicant's arguments filed 1/13/2006 with respect to claims 1, 3-20 have been fully considered but they are not persuasive.

The Applicants assert that Utagawa teaches away from the present invention. The Applicants argue that Utagawa fails to teach or suggest "relatively weighing the pixel signal values, the relative weights depending, at least in part, on the relative change of pixel signal value level in a particular direction... and computing the color signal value based upon contributions from both directions." Specifically, the Applicants argue: when the interpolation processor in Utagawa recognizes that the calculations of the correlation amounts in the four directions are impossible, the average value of the pixel outputs of the grid points that are adjacent to the empty grid point becomes the interpolation amount (Utagawa at column 10, lines 11-62). See Remarks, pages 7-9.

In response, the Examiner respectfully disagrees. Although Utagawa discloses the use of average value of pixel outputs of the grid points that are adjacent to the empty grid point for interpolation (step S23 of Fig. 8 or S13 of Fig. 4) when the calculation of the correlation amounts in the four directions are impossible (NO in step S22 of Fig. 8 or S12 of Fig. 4), at least the disclosure of steps S24, S25, S26 & S27 shown in Fig. 8 or similar steps shown in Fig. 4 has met the present claim limitations. First of all, each of the independent claims 1, 13, 16 & 19 does not exclude a possibility of using the average value of pixel signals for interpolating missing pixel values beside the directional weighting method. It is clear that each of these claims begins with an open ended "comprising:" and there is no limitation in the claims to exclusively claim the present invention as the only directional weighting method for color interpolation. Thus, the claimed invention is *at least* met by the directional weighting method taught by Utagawa when the calculation of correlation amount in four directions is possible (YES in S22). Secondly, Utagawa clearly teaches, in Fig. 8, col. 10, line 57 – col. 12, line 26, relatively weighting the pixel signal values (S25, S26) based on the relative change of pixel signal value level in a particular direction (S24, col. 11, lines 55-62, wherein the direction having a strongest correlation is weighted heavily with weighting factor $\alpha = 1$) and computing the color signal value $G'(k,p)$ based upon contributions from both directions.

With respect to the Applicant's assertion for no suggestion to combine Utagawa with Hamilton and Cok for claims 7-12 (Remarks, page 10), the Examiner would like to

submit the same motivations for combining the references as provided in the previous Office Action mailed 7/7/2005.

At least in view of the above, the claim rejections are maintained.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1, 3-6 & 13-20 are rejected under 35 U.S.C. 102(e) as being anticipated by Utagawa (US 6,563,538 B1).

Regarding claim 1, Utagawa discloses a method of interpolating color pixel signals from a subsampled color image (Figs. 7, 8 & 16A & B; col. 1, lines 15-21) comprising:

for a particular pixel location (a missing green color pixel at red or blue pixel or so called empty grid points) in the subsampled image (see col. 5, lines 54-57 and col. 6, lines 3-12), comparing relative changes (correlation) in a particular color pixel signal level for two mutually orthogonal directions (i.e., up-down, right-left directions) across said particular pixel location using pixel signal values immediately adjacent to said

Art Unit: 2615

particular pixel location, and computing a color signal value (missing green color value $G'(k, p)$) for that particular pixel location for a color plane (red color plane or blue color plane) other than the color plane of the pixel signal value in the subsampled color image at that location by relatively weighing the pixel signal values, the relative weights depending, at least in part, on the relative change (correlation) of pixel signal value level in a particular direction, wherein computing a color signal includes relatively weighing the pixel signal values by relatively weighing more heavily the pixel signal values associated with the direction increasing less relatively in pixel signal value level (strong correlation) for the particular pixel location and computing the color signal value (i.e., $G'(k, p)$) based upon contributions from both directions. **See Figs. 7 & 8; col. 10, line 11 – col. 12, line 16.**

Regarding claims 3 & 4, it is clear in Utagawa that the subsampled image comprises an image in RGB color space format and it is arranged in a Bayer pattern (see Figs. 16A & B; col. 5, lines 54-57 and col. 6, lines 2-12).

Regarding claim 5, Utagawa also discloses the color plane of the pixel signal value at said particular pixel location comprises the R color plane; the two mutually orthogonal directions comprising the horizontal and vertical directions (up/down and right/left directions), the particular color plane for the color signal value being computed comprises the G plane; and the particular color for the pixel signal value levels being compared comprises G (col. 6, lines 2-12 and col. 10, line 63 – col. 11, line 11).

Regarding claim 6, see the analysis of claim 5, wherein a missing green color value at blue pixel location is computed in the same way as missing green color value at red pixel location.

Regarding claim 13, see the analysis of claim 1. Furthermore, Utagawa clearly discloses a storage medium (i.e., CD-ROM or other kind of storage medium), having stored thereon instructions, which when executed by a system capable of executing the instructions, result in interpolating color pixel signal values from a subsampled image as analyzed in claim 1. See col. 4, lines 29-34.

Regarding claims 14 & 15, see the analyses of claims 3 & 4, respectively.

Regarding claim 16, see the analysis of claim 1. Also disclosed by Utagawa is an integrated circuit (processor 46; see Fig. 7) comprising electronic circuit adapted to process pixel signals, wherein the electronic circuitry is further adapted to interpolate color pixel signal values from a subsampled image as analyzed in claim 1.

Regarding claims 17 & 18, see the analyses of claims 3 & 4, respectively.

Regarding claim 19, see the analysis of claim 1. It is clear that a computing platform is disclosed by Utagawa (either an electronic camera platform as shown in Fig.

Art Unit: 2615

7 or a personal computer as shown in Fig. 14, col. 23, lines 47-61) to perform the interpolation method as analyzed in claim 1.

Regarding claim 20, see the analysis of claim 3.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 7-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Utagawa (US 6,563,538 B1) in view of Hamilton, Jr. et al. (US 5,629,734) and in further view of Cok (US 4,642,678).

Regarding claim 7, Utagawa further discloses that the interpolation process for missing green color values at red and blue color pixels are computed not only based on contributions of adjacent pixel signals in vertical and horizontal directions but also based on contributions of adjacent pixels signals in diagonal directions (see col. 20, lines 54-61). Utagawa is silent about computing missing blue (B) color value at red (R) color pixel based on the main diagonal and the secondary diagonal directions and the particular color for the pixel signal value level being compared comprises B hue. As taught by Hamilton, red and blue interpolation processes are performed based on

Art Unit: 2615

relative changes in signal levels of adjacent pixels (so called classifiers) in two diagonal directions in a well-known fashion. See Hamilton, col. 4, line 61 – col. 5, line 6.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to further include in Utagawa an interpolation method for missing blue (B) color value at red (R) color pixel and missing red (R) color value at blue (B) color pixel based on relative changes in signal levels of adjacent pixels in both main diagonal and secondary diagonal directions as a similar method as the method of interpolation of missing green (G) color so that a complete interpolation process for each of R, G and B colors would be established.

Although Utagawa and Hamilton do not teach that the particular color for the pixel signal value being compared comprises B hue, such deficiency is compensated by the teaching of Cok. Cok teaches red and blue hue component producing means (to produce HR and HB) for use in red and blue interpolation process so that color fringes are reduced in areas of image detail without introducing hue shifts in these areas to smoothly produce hue changes from one sampling location to the next (see Cok, col. 4, lines 12-20 and col. 5, lines 20-59).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to improve the interpolation process in the combined teachings of Utagawa and Hamilton by including blue hue components in the comparison of classifiers in two diagonal directions for interpolating missing B signal value at R pixel location so as to reduce color fringes in areas of image detail without introducing hue shifts in these areas.

Regarding claim 9, see the analysis of claim 7, wherein the interpolation of R signal value at B pixel location is implemented in the same manner.

Regarding claims 11 & 12, Cok discloses in Fig. 6 and col. 6, line 62 – col. 7, line 45 that missing R or B at G pixel location is computed in two vertical and horizontal directions, the particular color plane for the color signal value being computed respectively comprising R or B plane, and the particular color for the pixel signal value level being comparing respectively comprising R or B hue.

Regarding claims 8 & 10, see the analysis of claims 11 & 12, and note that the disclosure in Cok, col. 6, line 62 – col. 7, line 45 encompasses the limitations of each of the claims 8 & 10, wherein the interpolation of a blue/red pixel signal value at a green pixel location is based at least in part on computed B/R pixel signal value levels for red pixel locations adjacent said green pixel location and also on existing blue/red pixel locations adjacent said green pixel location in a mutually orthogonal direction to said adjacent red/blue pixel locations in the subsampled color image.

Conclusion

5. All claims are drawn to the same invention claimed in the earlier application and could have been finally rejected on the grounds and art of record in the next Office action if they had been entered in the earlier application. Accordingly, **THIS ACTION IS**

Art Unit: 2615

MADE FINAL even though it is a first action in this case. See MPEP § 706.07(b).

Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no, however, event will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nhan T. Tran whose telephone number is (571) 272-7371. The examiner can normally be reached on Monday - Thursday, 7:30am - 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Ometz can be reached on (571) 272-7593. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2615

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

NT.

A handwritten signature in black ink, appearing to read 'David Ometz', with a long horizontal line extending to the right.

DAVID OMETZ
SUPERVISORY PATENT EXAMINER